THALAMIC LESIONS IN DOGS. NEUROANATOMIC REVIEW.

Faculty of Veterinary medicine

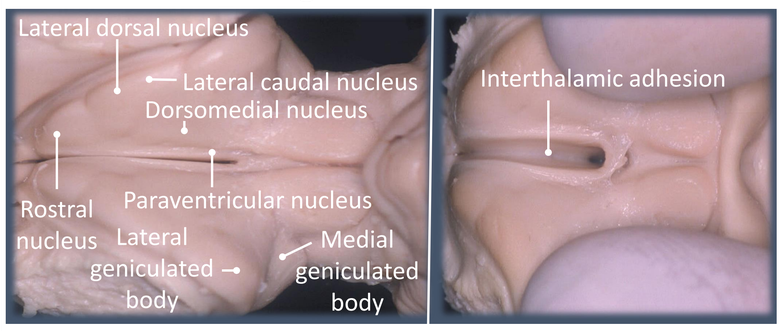
INTRODUCTION

Neurological examination allows clinicians to localize lesions within the nervous system (NS), determine its severity and establish a differential diagnose. In thalamic lesions, the clinical signs observed during the initial neurologic examination might lead the clinician to mislocalize the lesion.

The aim of this study is twofold. In the first instance, a thorough understanding of the thalamus anatomy and identification of the main pathologies. Secondly, it is aimed to establish links between the symptomatology derived from thalamic lesions and the affected nuclei.

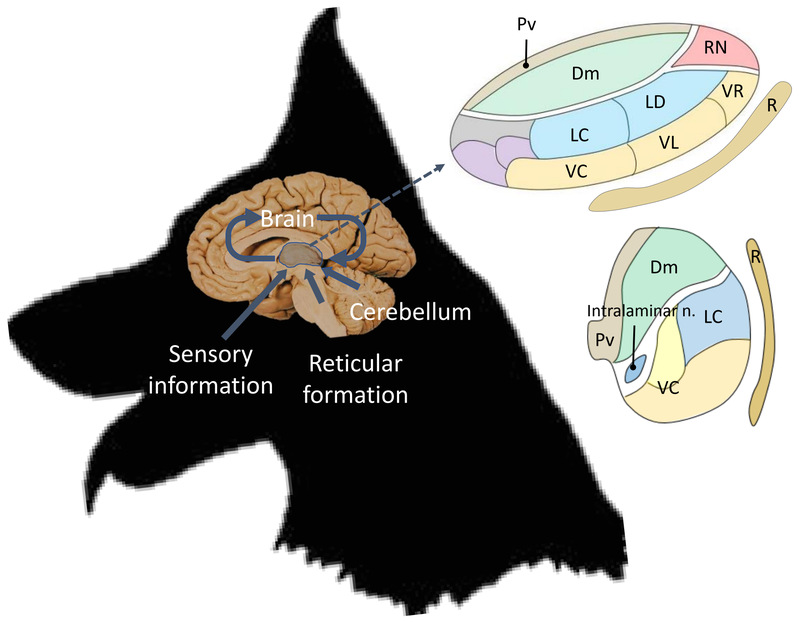
THE THALAMUS OF THE DOG

The thalamus is a bilateral and symmetric structure formed by the right and the left thalamus. These two thalami come together at the midline forming the interthalamic adhesion.



The thalamus is composed by several nuclei divided into four groups regarding their location to the external and internal medullary laminae.

The thalamus is often described as a relay station. This is because all the sensory pathways (except olfaction related) travel through the thalamus to the cerebral cortex. Each nucleus possesses functional specializations for dealing with particular types of data and afterwards send it to the appropriate area in the cortex.



The thalamus also receives inputs from the brain, the cerebellum and the reticular formation.

	THALAMIC NUCLEUS	AFERENCES	EFERENCES
ROSTRO-DORSO-MEDIAL GROUP	Rostral nuclei (RN)	Mamillary body, globus pallidus	Cingulate gyrus
	Paraventricular nuclei (Pv)	Hypothalamus, reticular formation, nucleus accumbens hippocampal formation	Cingulate gyrus
	Dorsomedial n. (Dm)	Hypothalamus, amygdala	Prefrontal cortex
INTRALAM.	Central lateral n.	Reticular formation, pallidus, cerebral cortex, cerebelar cortex	Cerebral cortex
	Central medial n.		
LATERO-VENTRO-CAUDAL GROUP	Ventral rostral n. (VR)	Cerebellum, pallidum	Premotor cortex
	Ventral lateral n. (VL)	Substantia nigra, vestibular nuclei, fastigial nucleus, dentate nucleus	Premotor and motor cortex
	Ventral caudal n. (VC)	Medial lemniscus, trigeminal lemniscus	Sensory cortex
	Lateral caudal n. (LC)	Rostral colliculi, pretectal area	Temporal, parietal and occipital cortex
	Lateral dorsal n. (LD)	Cingulate Gyrus	Cingulate Gyrus
	Reticular nucleus (R)	Collateral branches from talamocortical and cortico-thalamic fibers	Thalamic nuclei

THALAMIC PATHOLOGY

SYMPTOMATOLOGY

Clinical signs that might be seen and thalamic related nuclei affected according to de Lahunta and Glass:

- Ventral caudal nucleus → Reduced proprioception and hypalgesia of the neck, the trunk and contralateral limbs
- Posteromedial nucleus (medial portion od the VC) → Contralateral hypoalgesia of the head
- Ventral lateral nucleus → Hipermetria and ataxia
- Ventral rostral nucleus → Reduced postural reactions
- Reticular nucleus → Consciousness
- Dorsomedial and paraventricular nuclei → Behavioral abnormalities
- Lateral geniculated body → Contralateral hemianopsia
- Medial geniculated body → Vestibular ataxia

ETHIOLOGY

Focal thalamic lesions are relatively uncommon. The most common disorders affecting the thalamus are vascular (ischemic) and neoplastic.

VASCULAR

The experience of some clinicians suggest that thalamic infarctions are more common than it is recorded in the bibliography (15% of the brain infarctions in dogs). It is not confirmed but there might be breed and sex predisposition, being Cavalier King Charles Spaniel and Greyhounds the most represented breeds in retrospective studies and males further than females

NEOPLASIA

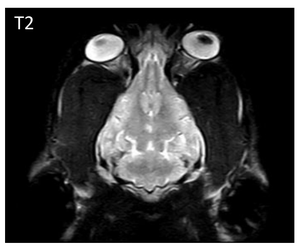
The incidence of intracranial neoplasia in the dog is 14,5/100.000. Intracranial tumors can affect dogs of any sex and age, although they occur more frequently in dogs older than 5 years.

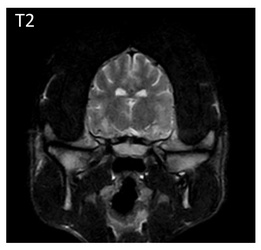
DIAGNOSIS – MAGNETIC RESONANCE (MR)

MRI is the method of choice for brain examination as it demonstrates superior soft tissue contrast than CT scans.

CASE 1 – THALAMIC INFARCTION

Clinical signs: Mild right head tilt and difficulty to initiate gait more marked in the left forelimb.



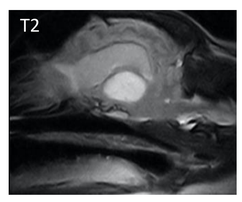


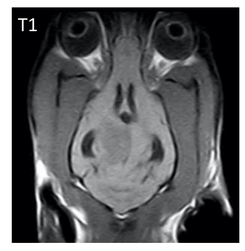
MR findings: Hyperintense signal on T2 sequence of a lacunar infarction in the right thalamus.

CASE 2 – NEOPLASIA

Clinical signs: Circling to the right.

MR findings: Hypointense (T1) and hyperintense (T2) signal of a well-delimited intraxial lesion affecting the right thalamus and compressing the left thalamus.





CONCLUSIONS

- The most common clinical signs found in dogs with thalamic lesion are similar to those included in the so-called vestibular syndrome (ipsilateral head tilt, head turn and circling). Thus, thalamus must be considered as a potential affected area when a dog exhibits vestibular signs.
- The localization of thalamic lesions is a major challenge due to the great number of connections between the thalamus and related structures. Furthermore, the incidence of isolated thalamic lesions and the diagnostic capability are too low to establish reliable links.
- Further studies based on MRI findings together with the whole clinical story of the patient are needed to be able to establish specific clinical patterns of thalamic dysfunctions.

REFERENCES

Aige Gil V. 2002. El encéfalo de perro. Atlas fotográfico (The dog's encephalon. Photographic atlas). Manuals veterinària. Universitat Autònoma de Barcelona.
Aige Gil V. Neuroanatomy of the dog.
De Lahunta A, N Glass E, Kent M. 2015. Veterinary neuroanatomy and clinical neurology. 3th ed. ELSEVIER.
Gonçalves R, Carrera I, Garosi L, Smith PM, McConnell JF, Penderis J. 2011. Clinical and topographic magnetic resonance imaging characteristics of suspected thalamic infarcts in 16 dogs. Vet. J. 188:39–43. doi:10.1016/J.TVJL.2010.03.024.
Raurell X, Centellas C, Zamora A, Lasheras L, Pumarola M. Diagnóstico y tratamiento de los tumores intracraniales.

Alexandra Rodríguez Tozzi
Gener de 2018

Universitat Autònoma de Barcelona